

A REFINED CONCEPT IN THE ORTHOTIC MANAGEMENT OF SCOLIOSIS —A PRELIMINARY REPORT—

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Idiopathic scoliosis is a medical enigma. It exists presently as a clinical entity without a known etiology. Several experimental manipulations in animal models have been successful in reproducing spinal curvatures, but to date none of these experiments, it seems, has advanced significantly the remedy for scoliosis.

Valuable contemporary contributions to the surgical amelioration of spinal deformities have been made by Harrington (6) and Dwyer (3,4,5). These techniques for spinal fusion afford the surgeon new confidence in achieving and maintaining an enhanced degree of correction of the scoliosis.

Although ancient and twentieth century medical literature offered an awesome array of spinal orthoses, it was fundamentally the pioneering of Dr. Walter Blount and Dr. Albert Schmidt (1) that has provided the medical profession with the "Milwaukee Brace," an orthosis that can successfully abort the progression of scoliosis. When fabrication and fitting of the Milwaukee Brace are carried out properly, carefully selected individuals suffering from scoliosis can be treated successfully without surgery. These vital prerequisites must be combined with a structured exercise program in order for the treatment to yield optimum results.

The conventional Milwaukee Brace has undergone many modifications since its creation, but the metal vertical superstructure with a pelvic foundation still comprises the basic components.

The Milwaukee design has been well received, in spite of its unconventional approach, but even its innovators will admit the Milwaukee Brace still leaves something to be desired. It requires considerable time to fabricate and fit. With the

superstructure its appearance is ungainly—a very real factor in the age group for which treatment is generally needed.

In an effort to overcome some of the well-recognized problems associated with the "Milwaukee Brace," a design that has been designated the "Boston System for Non-Operative Control of Scoliosis" has been developed and applied at the Children's Hospital Medical Center, Harvard University.

The system is based on the Milwaukee Brace concept but the necessity to take a cast, pour, and rectify a positive model is eliminated in an estimated 95 percent of the cases by use of pre-fabricated plastic pelvic girdles (Fig. 1). The

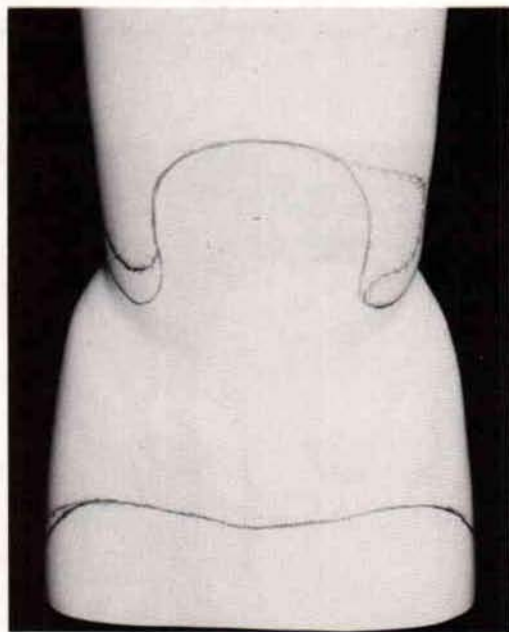


Fig. 1. Preformed polypropylene pelvic girdle. Typical trimlines can be seen. Sixteen sizes are available, but six seem to be all that is needed for 80 percent of the patients.

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girdle is fitted so that its entire inner surface is in contact with the skin (Fig. 2). A superstructure may or may not be used, depending upon the severity and type of case (Figs. 3 and 4).

The pelvic girdles are molded of sheet polypropylene and lined with Ali-Med, a synthetic sponge. Pelvic tilt is incorporated and the lumbar pad is an integral part of the structure.

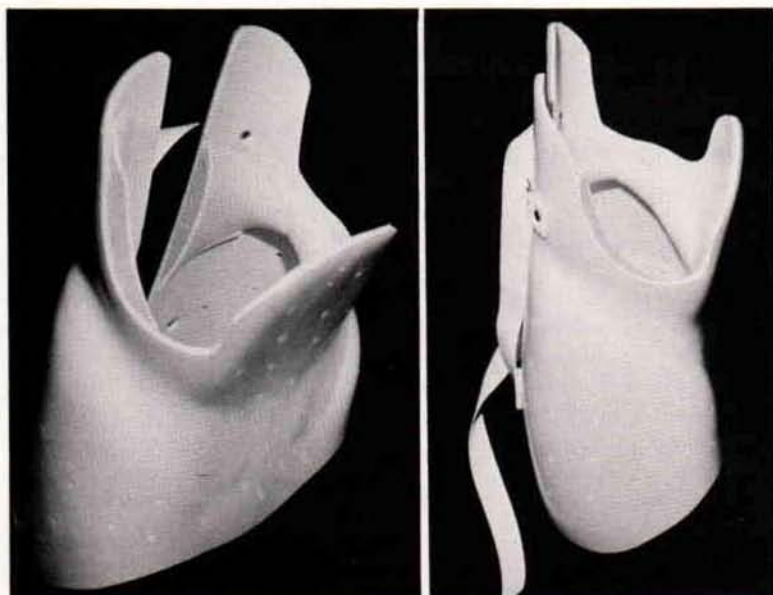


Fig. 2. Two views of polypropylene pelvic girdle lined with synthetic sponge, trimmed, and ready for fitting.

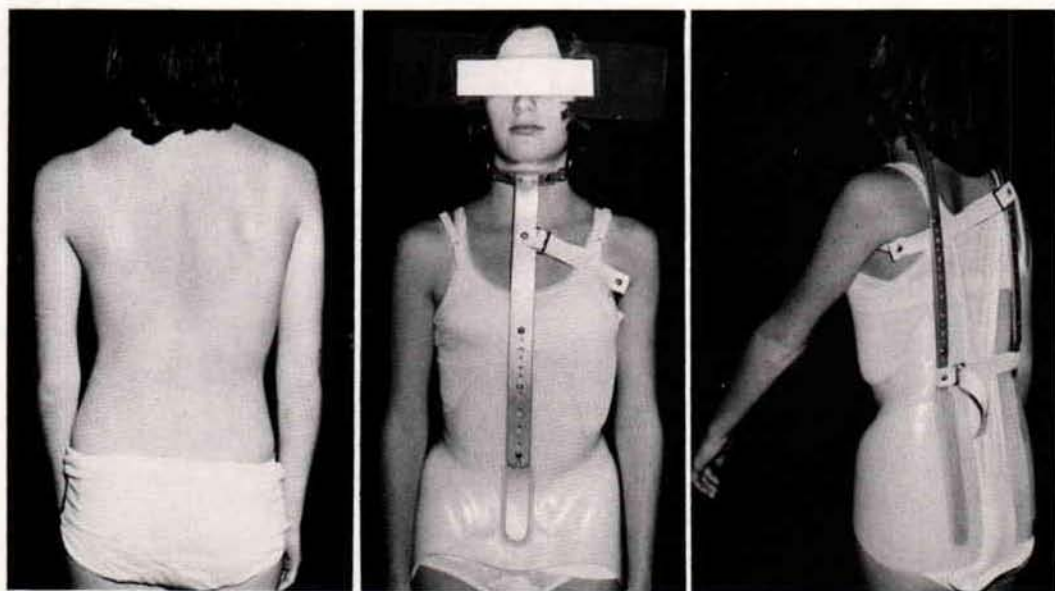


Fig. 3. An example of the Boston System when the superstructure is used.



Fig. 4. An example of the Boston System when the superstructure is not used.

"Total contact" is provided, but the pressure is not distributed uniformly, since relief areas are incorporated so as to allow the pathological curve to move to a more ideal position. Static correction of the curve is achieved by direct stress via orthosis, and dynamic correction is accomplished by exercises executed while in the orthosis. These static and dynamic stresses encourage the pathological curve to migrate to the relief area.

The pelvic girdle is available in 16 sizes. Six of these sizes seem to be all that are needed to fit 80 percent of patients for whom an orthosis is prescribed. All 16 sizes make it possible to fit about 95 percent of the cases, and the remainder require a custom-made girdle.

Although fabrication and delivery times are shortened, proper application requires a great deal of knowledge and skill, and therefore should not be attempted until the team has had adequate training.

The advantages of the Boston System are:

1. A reduction in fitting and fabrication times
2. A reduction in delivery time
3. A reduction in skin problems owing to the

intimate fit which tends to decrease the degree of shear between orthosis and skin.

4. Improved control of lumbar and thoracolumbar curves owing to the intimate fit of the girdle.

5. A reduction in maintenance problems, owing mainly to the properties of polypropylene.

6. Improved cosmesis (when the superstructure can be eliminated).

EVALUATION

At the Scoliosis Clinic of the Children's Hospital Medical Center approximately 2000 patients with various forms of spinal deformities are followed at any one time. About 500 new patients are seen annually. For approximately three years our team has used the Boston System in an effort to determine its effectiveness.

OBJECTIVES OF STUDY

The study was carried out in an effort to assess two major areas:

1. *Toleration of the Device:* It was an objective to ascertain whether the patient could tolerate the rigid construction of the orthosis designed for total contact. Also, an attempt was made to gain some insight into the greater ease of socialization for the child fitted with this type of orthosis.

2. *Curve Correction and Maintenance of Correction:* It was felt to be imperative that a report be offered on the degree of correction achieved with the Boston System, and also to offer a preliminary report on the maintenance of the correction.

COMPOSITION OF THE GROUP STUDIED

A group of 200 patients was selected on a random basis from the files of the Scoliosis Clinic at the Children's Hospital Medical Center.

Each of these two hundred patients met the following criteria:

1. Had scoliosis that has been diagnosed as idiopathic.
2. Had been fitted with the Boston System, with or without superstructure.
3. Would be a participant in a follow-up program conducted by the orthopaedic staff in con-

junction with the personnel of the National Orthotic and Prosthetic Company who operate the orthotics facility on the premises of the Children's Hospital Medical Center.

SOURCES OF DATA

The data were obtained from chart and radiological review, questionnaire, personal interview, and examination.

The clinic and hospital charts of all patients were reviewed completely. Roentgenograms were also reviewed and measurements recorded according to the Cobb method (2). Patients were categorized according to curve patterns as follows:

1. Thoracic
2. Thoracolumbar
3. Lumbar
4. Double curve

The questionnaire was administered to the patient and the parent attending. This was carried out at the time of personal interview and examination of the patient in most instances. Telephone interviews were employed to augment the data when needed for completeness.

RESULTS

Curve Pattern—Thoracic:

Number of patients	62
Sex Incidence	54 females 8 males
Mean Age at Time of Diagnosis	11 8/12 years old
Mean Age at Time of Bracing	12 2/12 years old
Mean Age at Application of the Boston System	12 8/12 years old
Patients fitted with Boston System including the superstructure	50
Patients fitted with Boston System without the superstructure	12

Mean Initial Curve with Boston System including the superstructure	33 degrees
Mean Prime Correction	21 degrees
Percent Correction	36

Mean Initial Curve with Boston System without the superstructure	24 degrees
Mean Prime Correction	10 degrees
Percent Correction	58

Skin Problems: Nil	32 patients = 52 percent
Mild	24 patients = 38 percent
Moderate	3 patients = 4 percent
Severe	0

Pain: Nil	36 patients = 58 percent
Mild	24 patients = 38 percent
Moderate	0
Severe	2 patients = 4 percent

Socialization: Normal	46 patients = 74 percent
Abnormal	16 patients = 26 percent

Rejection of Orthosis	
Partial	5 patients = 8 percent
Complete	1 patient = 1.6 percent

Patients weaned without progression of curve	2
Patients weaned with progression of curve	1

Comments:

1. Skin problems are deemed to be mild when there is merely hyperemia without blistering; moderate is defined as skin irritation to the point of blistering in one focus; severe skin problem is defined as blistering in more than one focus.

2. Mild pain is that discomfort which does not promote removal of the orthosis for any portion of the prescribed wearing time; severe pain is when the brace cannot be tolerated whatsoever.

3. Socialization is abnormal when either the child or a parent confesses that wearing the Boston System handicaps the child from doing activities that she has a desire to do, i.e., school activities, athletics, and coeducational social activities.

4. One patient weaned with progression of her curve progressed three deg. from 12 deg. to 15 deg., over a two-year period. On her last visit she had arrested at 15 deg.

Curve Pattern—Thoracolumbar:

Number of Patients	54
Sex Incidence	50 females 4 males
Mean Age at Time of Diagnosis	12 8/12 years old
Mean Age at Time of Bracing	13 years old
Mean Age at Application of the Boston System	13 3/12 years old
Patients fitted with Boston System with the "Milwaukee" superstructure	10
Patients fitted with Boston System without the "Milwaukee" superstructure	44
Mean Initial Curve with Boston System with the "Milwaukee" superstructure	24 degrees
Mean Prime Correction	15 degrees
Percent Correction	42
Mean Initial Curve with Boston System without the "Milwaukee" superstructure	25 degrees
Mean Prime Correction	10 degrees
Percent Correction	64
Skin Problems:	
Nil	38 patients = 70 percent
Mild	12 patients = 22 percent
Moderate	0
Severe	4 patients = 8 percent
Pain:	
Nil	38 patients = 70 percent
Mild	16 patients = 30 percent
Moderate	0 patients
Severe	0 patients

Socialization:	Normal	48 patients = 88 percent
	Abnormal	6 patients = 12 percent

Rejection of Orthosis:	Partial	2 patients
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Patients weaned without progression of curve	1
Patients weaned with progression of curve	2

Comments:

1. One patient who absolutely refused to wear the Boston System with the metal superstructure also refused to wear the modified pelvic girdle alone, and progressed to spinal fusion with Harrington instrumentation.

The second patient was converted to the Boston System without superstructure and has been controlled since that time.

2. Of the two patients who progressed following weaning, one patient has lost three deg. of correction which is considered negligible at the present time. However, one patient who presented with a 30-deg. curve had a prime correction of 12 deg. after an insidious weaning period progressed to 35 deg., and went on to spinal fusion with Harrington instrumentation.

Curve Pattern—Lumbar:

Number of Patients	26
Sex Incidence	22 females 4 males
Mean Age at Time of Diagnosis	13 1/2 years old
Mean Age at Time of Bracing	14 years old
Mean Age at Time of Bracing with the Boston System	14 2/12 years old
Patients fitted with the Boston System with the "Milwaukee" superstructure	0

Patients fitted with the Boston System without the "Milwaukee" superstructure 26

Mean Initial Curve with the Boston System 26 degrees
 Mean Prime Correction 12 degrees
 Percent Correction 54

Skin Problems: Nil 20 patients = 76 percent
 Mild 6 patients = 24 percent
 Moderate 0 patients
 Severe 0 patients

Pain: Nil 20 patients = 76 percent
 Mild 0 patients
 Moderate 6 patients = 24 percent
 Severe 0 patients

Socialization: Normal 24 patients = 92 percent
 Abnormal 2 patients = 8 percent

Rejection of Orthosis: Partial 0 patients
 Complete 0 patients

Patients weaned without progression of curve 1 patient

Patients weaned with progression of curve 0 patients

Curve Pattern—Double Curve:

Number of Patients 58

Sex Incidence 56 females
 2 males

Mean Age at Time of Diagnosis 11 7/12 years old

Mean Age at Time of Bracing 12 9/12 years old

Mean Age at Time of Bracing with the Boston System 13 years old

Patients fitted with the Boston System with the "Milwaukee" superstructure 30

Patients fitted with the Boston System without the "Milwaukee" superstructure 28

Mean Initial Curve with the Boston System with the "Milwaukee" superstructure 26 degrees
 Mean Prime Correction 18 degrees
 Percent Correction 30

Mean Initial Curve with the Boston System without the superstructure 27 degrees

Mean Prime Correction 14 degrees
 Percent Correction 49

Skin Problems: Nil 44 patients = 75 percent
 Mild 12 patients = 21 percent
 Moderate 2 patients = 4 percent
 Severe 0 patients

Pain: Nil 46 patients = 77 percent
 Mild 12 patients = 23 percent
 Moderate 0 patients
 Severe 0 patients

Socialization: Normal 50 patients = 86 percent
 Abnormal 8 patients = 14 percent

Orthosis Rejection: Partial 0 patients
 Complete 0 patients

Patients weaned without progression of the curve 2 patients

Patients weaned with progression of the curve 1 patient

Comments:

The one patient who has progressed following weaning deteriorated from an 18–24 deg. curve to a 20–30 deg. curve over a one-year period. This progression occurred after a program using the Boston System without a superstructure.

CONCLUSIONS

The Boston Scoliosis Orthosis is a prefabricated appliance for the nonsurgical treatment of idiopathic scoliosis. Constructed, primarily, from sheet polypropylene, the orthosis is designed to offer a total-contact fit.

In patients selected properly, the need for the metal superstructure is obviated. Preliminary report of 200 patients with idiopathic scoliosis treated with the Boston System reveals, after a mean follow-up period of 17 months, a 28 deg. curve (mean) can be corrected to a 14 deg. curve (mean) yielding a 50 percent correction. While wearing the brace 20 hours per day (mean), 85 percent of the patients enjoyed a completely normal life style.

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